JAMA Insights

Alcohol and Cancer Risk

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In 2025, the US Surgeon General's Advisory on alcohol and cancer risk recommended updating the warning label on alcohol-containing beverages to include cancer, counseling patients about alcohol as a cancer risk factor, and promoting alcohol intervention strategies in clinical settings.[1] Below, we summarize the evidence related to this recommendation.

Alcohol-Related Cancers

Alcohol-related cancers include cancers of the mouth, pharynx, larynx, esophagus, breast, colorectum, and liver.[1] In 2020, an estimated 740 000 cancer cases globally (4.1%) were attributable to alcohol consumption, with most occurring in men (76.7%).[2] In the US, alcohol was identified as the third-leading modifiable cancer risk factor after cigarette smoking and excess weight, contributing to 5.4% of cases and 4.1% of deaths among adults 30 years or older in 2019.[3]

Supplemental content

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Proposed Biological Mechanisms

The primary carcinogenic effects of alcohol (ethanol) are attributed to its metabolite acetaldehyde, which can disrupt DNA synthesis, repair, and methylation.[4] Carriers of the *ALDH2*2* variation, most prevalent among East Asian individuals, metabolize acetaldehyde slower, causing greater carcinogenic effects at lower amounts of alcohol.[4] Additionally, alcohol can produce inflammation and oxidative stress.[4] Heavy alcohol use (5 or more drinks/d), typically over a period of at least 5 to 10 years, can cause cirrhosis, a risk factor for hepatocellular carcinoma.[4,5] Alcohol also increases estrogen levels, increasing breast cancer risk, and acts as a solvent for other carcinogens, such as those in tobacco, increasing the risk of oral and gastrointestinal cancer.[4,6] Other proposed carcinogenic mechanisms of alcohol include disruption of one-carbon and folate metabolism essential for DNA methylation and synthesis; altered retinoid metabolism affecting cell growth, differentiation, and apoptosis; reduced immune function; and dysbiosis of the oral and intestinal microbiome, increasing acetaldehyde levels and inflammation.[4]

Dose-Response Relationship and Drinking Categories

Cancer risk increases with higher amounts of alcohol consumption. Although some studies categorize drinking as *light*, *moderate*, and *heavy*, these quantities are not standardized, and definitions vary across studies. Additionally, the definition of a standard drink and alcohol consumption levels differ across countries. The Dietary Guidelines for Americans define a standard drink as 14 g of ethanol, equivalent to approximately 12 oz of beer, 5 oz of wine, and 1.5 oz of distilled spirits. In the US, heavy alcohol use is defined as 5 or more drinks daily or 15 or more drinks weekly for men, and 4 or more drinks daily or 8 or more drinks weekly for women. While moderate and light consumption are not clearly differentiated in the US, the Dietary Guidelines for Americans refer to "drinking in moderation" as not exceeding 2 drinks daily for men and 1 drink daily for women.

Challenges in Evaluating Alcohol-Related Cancer Risk

Because evidence is based on observational studies, risk of bias affects the evaluation of these associations, particularly at lower consumption levels. Potential confounding factors include cigarette smoking, body mass index, physical activity, diet, and education.[6] Additionally, abstainer bias, which includes those who have stopped drinking or never drank due to health conditions, further complicates analyses when these individuals are included in the comparison group.[6] Other sources of potential bias include underreporting of alcohol consumption and selection bias.[6]

Alcohol-Related Cancer Risk and Consumption Levels

Heavy alcohol consumption is associated with the greatest risk for all 7 cancer types (Supplement).[2] At lower levels of alcohol consumption, conclusions from meta-analyses and expert reports often differ, depending on cancer type. To facilitate interpretation of relative risks, global population lifetime cancer risk (regardless of alcohol use) and global cases attributed to alcohol by cancer type are presented in the Supplement.[7]

Heavy Consumption

In a 2015 meta-analysis of 572 case-control and cohort studies published between 1956 and 2012, drinking more than 50 g of alcohol (approximately >3.5 drinks) per day, compared with not drinking or occasional drinking, was associated with increased risk of cancers of the mouth and pharynx, larynx, esophagus, female breast, colorectum, and liver (Supplement).[8] The 2018 World Cancer Research Fund (WCRF) Third Expert Report, a comprehensive synthesis that included the 2015 meta-analysis, found strong evidence supporting an increased risk of colorectal cancer associated with consuming approximately greater than or equal to 30 g (≥2 drinks) per day and of liver cancer associated with consuming approximately greater than or equal to 45 g (≥3 drinks) per day.[9]

Low to Moderate Consumption

A 2025 report by the National Academies of Sciences, Engineering, and Medicine (NASEM) systematically reviewed 23 cohort and 2 case-control studies, published between 2010 and 2014, that focused specifically on alcohol consumption of less than or equal to 28 g/d (≤2 drinks/d) in men or less than or equal to14 g/d (≤1 drink/d) in women and cancer risk.[6] The NASEM report only considered studies that used "never drinkers" in the comparison group, unlike the 2015 meta-analysis, which included individuals who previously or occasionally consumed alcohol in the comparison group.[6,8] However, restricting studies to never drinkers yielded few studies and therefore limited evidence.[6]

In the NASEM report, drinking less than or equal to 14 g/d (≤1 drink/d) in women was associated with a 10% increased breast cancer risk based on a meta-analysis of 4 cohort studies (n ≥100 937)

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and a 5% increased risk for every 10 to14 g of higher daily consumption (starting at 0 g/d) based on a meta-analysis of 7 cohort studies (n ≥409 592).[6] For cancers of the oral cavity, pharynx, larynx, and esophagus, evidence was insufficient to support an association between alcohol consumption of less than or equal to 28 g/d (≤2 drinks/d) in men or less than or equal to 14 g/d (≤1 drink/d) in women.[6]

The 2015 meta-analysis similarly reported positive associations between breast cancer risk and both light (≤12.5 g/d [approximately ≤1 drink/d]) and moderate (>12.5 to ≤50 g/d [approximately >1 to ≤3.5 drinks/d]) alcohol consumption, and increased colorectal cancer risk with moderate, but not light, consumption.[8] In contrast to the NASEM report, the 2015 meta-analysis reported that any consumption level was associated with an increased risk of oral, pharyngeal, and esophageal cancers in a dose-response manner.[8] However, when cohort studies were analyzed separately from case-control studies, associations were no longer statistically significant for light and moderate drinking with oral and pharyngeal cancers or light drinking with esophageal cancer.[8] The 2018 WCRF concluded that convincing evidence supports increased risk of cancers of the mouth, pharynx, larynx, esophagus, and female breast with any amount of alcohol consumption, following a dose-risk relationship with every 10-g increase in alcohol consumed per day starting at zero intake.[9] It also reported increased risk at any alcohol consumption level for estrogen-receptor-positive, but not estrogen receptor–negative breast tumors, with the strongest evidence for postmenopausal breast cancer.[9]

Clinical Implications

Clinicians should discuss with patients the cancer risks associated with alcohol use. For individuals who choose to drink, the Dietary Guidelines for Americans recommend not exceeding 2 drinks daily for men and 1 drink daily for women. However, even at these alcohol consumption levels, cancer risk may be increased for patients who smoke cigarettes, carry the *ALDH2*2* genetic variation (evident by a flushing response to alcohol), have a family history of alcohol-related cancer or alcohol use disorder (AUD), or have other alcohol-related diseases associated with cancer, such as liver disease.

Clinicians should screen for alcohol use with validated instruments, such as the Single Item Alcohol Screening Question, and perform brief interventions for those exceeding recommended limits.[10] The National Institute on Alcohol Abuse and Alcoholism provides guidance on performing brief interventions. Individuals with positive screening results should be evaluated for AUD, and those meeting diagnostic criteria should be offered treatment with medications (eg, naltrexone, acamprosate, disulfiram) and specialized counseling and/or support groups.

Conclusions

Any daily alcohol consumption is associated with certain cancers, and the risk of cancer increases with higher alcohol intake. Patient education, routine alcohol use screening, and AUD treatment, when indicated, can decrease these risks and promote overall health.

ARTICLE INFORMATION

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REFERENCES

1. Office of the Surgeon General. *Alcohol and Cancer Risk: The US Surgeon General's Advisory*. US Dept of Health and Human Services; 2025.

2. Rumgay H, Shield K, Charvat H, et al. Global burden of cancer in 2020 attributable to alcohol consumption: a population-based study. *Lancet Oncol*. 2021;22(8):1071-1080. doi:10.1016/S1470-2045(21)00279-5

3. Islami F, Marlow EC, Thomson B, et al. Proportion and number of cancer cases and deaths attributable to potentially modifiable risk factors in the United States, 2019. *CA Cancer J Clin*. 2024;74(5):405-432. doi:10.3322/caac.21858

4. Rumgay H, Murphy N, Ferrari P, Soerjomataram I. Alcohol and cancer: epidemiology and biological mechanisms. *Nutrients*. 2021;13(9):3173. doi:10.3390/nu13093173

5. Roerecke M, Vafaei A, Hasan OSM, et al. Alcohol consumption and risk of liver cirrhosis: a systematic review and meta-analysis. *Am J Gastroenterol*. 2019;114(10):1574-1586. doi:10.14309/ajg.0000000000000340

6. National Academies of Sciences, Engineering, and Medicine. *Review of Evidence on Alcohol and Health*. National Academies Press; 2025. Accessed March 22, 2025. doi:10.17226/28582

7. Zheng R, Wang S, Zhang S, et al. Global, regional, and national lifetime probabilities of developing cancer in 2020. *Sci Bull (Beijing)*. 2023;68(21):2620-2628. doi:10.1016/j.scib.2023.09.041

8. Bagnardi V, Rota M, Botteri E, et al. Alcohol consumption and site-specific cancer risk: a comprehensive dose-response meta-analysis. *Br J Cancer*. 2015;112(3):580-593. doi:10.1038/bjc.2014.579

9. World Cancer Research Fund/American Institute for Cancer Research. Continuous update project expert report 2018: alcoholic drinks and the risk of cancer. Accessed March 22, 2025. https://www.wcrf.org/wp-content/uploads/2024/10/Alcoholic-Drinks.pdf

10. O'Connor EA, Perdue LA, Senger CA, et al; US. Preventive Services Task Force Evidence Syntheses, formerly Systematic Evidence Reviews. Screening and behavioral counseling interventions to reduce unhealthy alcohol use in adolescents and adults: an updated systematic review for the US Preventive Services Task Force. *JAMA*. 2018;320;(18):1910-1928. doi:10.1001/jama.2018.12086

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